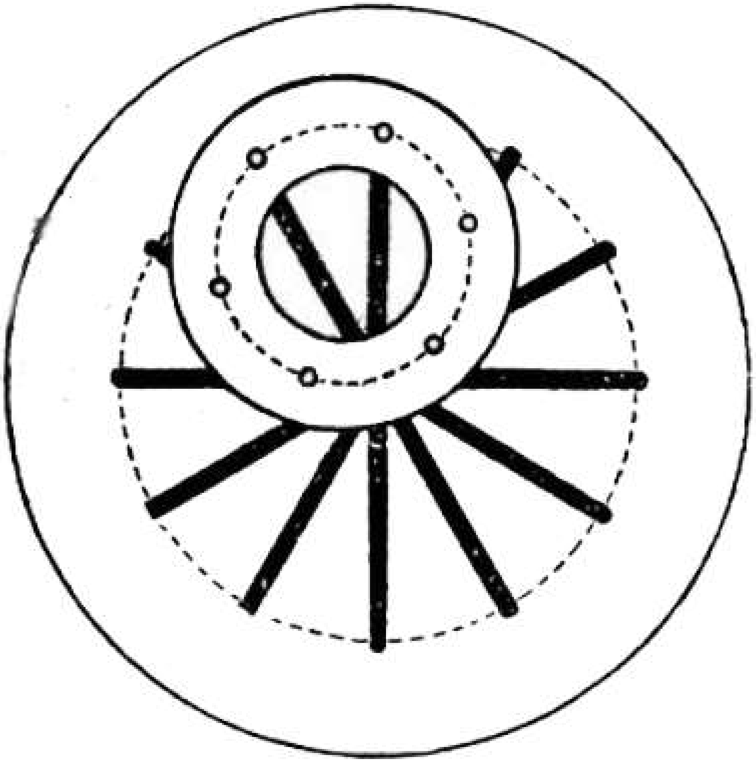
A NEW PUZZLE.

The following puzzle may possibly interest some of our readers during the long winter evenings. At all events it has the merit of novelty.

Cut out two discs of stiff cardboard; one having a circle drawn upon it of any diameter, say from two to three inches, and the other a circle of just twice the diameter; leaving good margins beyond. Divide the circumference of the smaller circle into any number of equal parts; six will be found practically the most convenient number: moreover, the division into six is easy; the radius of any circle applied, by means of a pair of compasses, from point to point of the circumference, goes exactly six times. Small round wooden pegs must be inserted at the points of division, and fastened with thick gum or sealing wax; the sticks of congreve matches cut into short lengths will answer the purpose well. Also, divide the large circle into twice as many parts as the small one, joining every two diametrically opposite points of division by straight lines passing through the centre of the circle. Along these lines, slits or grooves are to be cut out just wide enough to admit the pegs; and should be so cut that one of the lines previously drawn would (if not cut away) be exactly in the middle of each slit.

It will now be found that the small disc may be placed against the large one as in the diagram, each of the pegs passing through one of the slits. The centre of the small disc should previously be cut out, leaving the cardboard in the form of a ring, so as to hide the position of the slits as little as possible; and the puzzle will be completed by placing a similar ring (having a circle accurately divided as before, and perforated to receive the pegs) upon the opposite side of the large disc, the other ends of the pegs being passed through it and secured.

The puzzle is how to get the double ring of cardboard to the opposite edge of the large circle. It will be found that on giving the ring a Circular motion on its centre, it will at the same time move round the larger circle in the opposite direction.



The two cardboard rings should be made to hold the large disc tightly between, them, otherwise they will move too readily upon being touched, and the value of the puzzle, as a puzzle, will be impaired. The only points remaining to be noted are, first, that the slits in the large disc should be cut just so far beyond the divided circle as to allow the centres of the pegs (which centres should as nearly as possible coincide with the points of division in the small circle) to be at certain times in the circumference of the large circle; secondly, that the ring should be of such width (from its inner to its outer edge) as to cover all the points necessarily formed at the centre of the large disc by the crossing of the slits. This will keep them flat, and give completeness to the whole.

In the diagram the dotted circles are three which are to be divided, and of which one must be of a diameter exactly twice that of the other.

The above is founded upon the following mathematical principle: — Let there be two circles, one having a diameter double that of the other; and, the small circle being placed inside the large one touching its circumference, imagine a double motion to be given to the small circle such that it shall turn once upon its own centre in the same time in which it performs a complete revolution about the centre of the larger circle, the two motions being in opposite directions. Under these conditions it may be shown that every point in the circumference of the small circle moves in a straight line, namely, along some diameter of the large circle— -backwards and forwards as the motion is continued. It is this fact which enables the cardboard ring in the puzzle to move round the disc while paints in the circle described upon the former are confined to straight lines. Practically, it is not necessary to try to give the two equal motions; from the guidance afforded by the slits, and from the manner in which the pegs bear upon them, the rotary motion given to the ring naturally produces that of revolution also.

It is worth remarking that the double motion described above is the same as would be produced if, the two circles being placed relatively as there indicated, the smaller circle be conceived to roll along the circumference of the larger one; the two circumferences always touching and never sliding one on the other.

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Once a Week, Jan. 20, 1866.]